



## What is Six-Questions Cognitive Model?

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**Key Words:**

six-questions cognitive model  
mathematics  
deep learning

**Abstract:**

Knowledge transfer is not easy especially for mathematics. Various factors need to be considered and think about how to transfer the knowledge effectively. The traditional teaching method does not help students to achieve deep learning and to solve this problem, there is a need to new learning method. The 6-questions cognitive model is a new learning model that is developed in China in 2012. This model can stand on its own or be combined with technology-based learning media. This research aims to introduce the 6-questions cognitive model by using a qualitative method. Researchers did literature research to know the deeper meaning of the 6-questions cognitive model. The result of this research shows that the cognitive model can help students to achieve deep learning and it can also be combined with a technology-based learning media. Teachers can use this research result to teach mathematics in school. Future research can find out about the effect of 6-questions cognitive model on the students' high order thinking skill.

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## Introduction

Mathematics plays an important role in human life and the development of technology (Kulsum et al., 2019; Rohaeti, 2010; Utomo et al., 2018). Mathematical understanding skill is important for students to process, organize and solve problems that can change as time goes (Cunhua et al., 2019; Dewi et al., 2018; Wijaya et al., 2018). Education can equip students to achieve high order thinking skill (HOTS). HOTS is a thinking skill that is more than just memorizing and it needs understanding skills and connecting one to another, categorizing, manipulating and find new solutions to solve problems (Ilmi et al., 2020; Rosaini et al., 2019). Education also equip students to have a good attitude (Babinčáková et al., 2020), wide knowledge, critical thinking skills

(Nuraini et al., 2019), creative (Wijaya, Jianlan, et al., 2020), productive, collaborative and independent.

The thinking cognitive level has 6 stages: remembering, understanding, applying, analyzing, evaluation, and creation (figure 1) (Anderson, 2001; Babinčáková et al., 2020). From the 6 stages above, analyzing, evaluation, and creation is considered in the high order thinking skills. In the analysis stage, students should be able to solve problems and search important information in the problem. In the evaluation stage, students should be able to decide on their actions, recheck the problem, make a hypothesis and criticize. In the creation phase, students should think of new ideas, new ways of thinking, constructing and inventing.

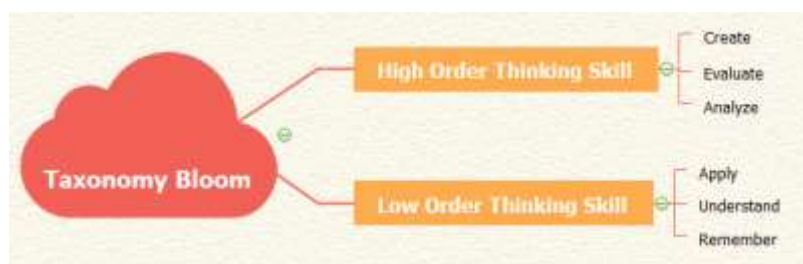


Figure 1. HOTS based on The Taxonomy Bloom

Mathematics high order thinking skill is a main skill that should be mastered by students International Mathematics and Science Study (TIMMS) and PISA can measure students' high order thinking skills. Here we can see students from various that has a good high order thinking skills.

Lower Order Thinking Skills (LOTS), which consists of remember, understand and apply, are low-level mathematical abilities that students get when studying mathematical concepts. students can easily master LOTS from closed-ended and multiple-choice questions. when students can answer

exam questions correctly, it proves that they have achieved the LOTS ability. different from HOTS, where students are challenged to answer questions with open-ended questions that make students unable to guess. Without a deep understanding, students cannot answer HOTS questions that require good thinking and understanding of concepts.

Researchers found out that HOTS can be taught, directed, adjusted and developed for students (Dinni, 2018). To be able to achieve HOTS, students should first achieve deep understanding and are able to connect one knowledge to another. Without a good basic

knowledge, students won't be able to achieve HOTS. Students should have a good understanding which means that they are able to connect the skills they have already learned with the knowledge that they are currently learning.

There are various researches to improve students' HOTS, including using learning media, learning model, and technology (Desania et al., 2020; Ilmi et al., 2020). However, most of these are to guide students to achieve deep learning. Based on this a professor from China, Prof. Zhou Ying, designed a learning model called the 6-questions cognitive model. This study we discuss how the 6-question cognitive model can guide students to achieve HOTS.

### **Research Method**

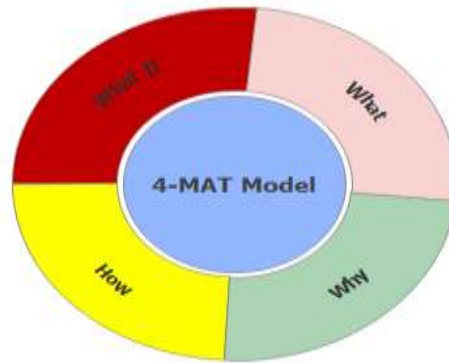
This research is a study of literature (Muthma'Innah, 2017). Researchers read and analyzed based on existing source and relevant studies. From the analysis result, researchers search for information and answers to the questions in this research that are in line with the purpose of this research. Relevant studies are papers that are related to the 6-questions cognitive model. Papers are taken from google scholar and Scopus. Scopus is one of the databases for science literature owned by an international publisher, Elsevier. Scopus was known back in 2004 and it has a wide range of journals compared to science direct. Not only Scopus provides a high-quality international journal, but it also provides patents data for various researchers in the world.

### **Results and Discussion**

In fact, every student faces difficulty in every subject they learn, but students always feel that mathematics is

harder than any other subjects . This is because mathematics is interconnected, so if students missed or failed to understand a topic, it would be difficult to understand the next one. This is why we need to find out difficulties faced by students so that teachers can find ways to overcome the problem. Even though tasks to improve students' HOTS are difficult, we can start from the basic and find out difficulties students face when learning mathematics. After analyzing the difficulties, researchers can develop a learning model to help students achieve deep learning and improve students HOTS.

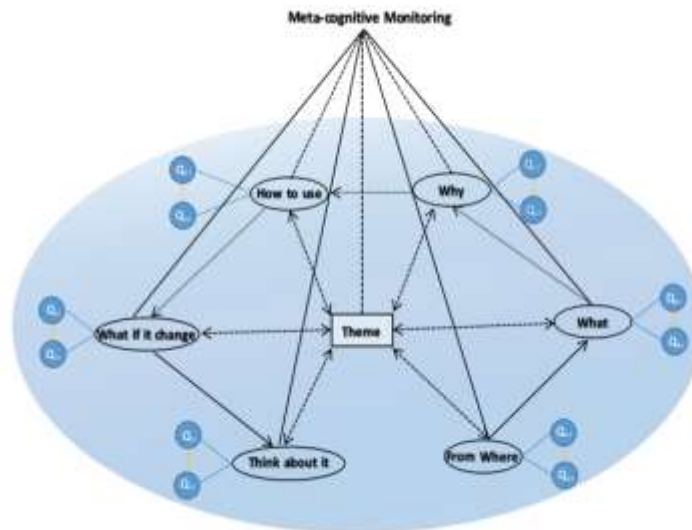
The 4-MAT is known in 1987. McCarthy feels that a learning model is an important factor in determining the students' success. Based on this, McCarthy introduced the 4-MAT learning model to help students find an effective learning method. Basically, the 4-MAT model is a dynamic and engaging learning system. The model is a learning framework that can help lecturers to effectively deliver information. This is why the 4-MAT model can still be developed according to the needs and current development. In figure 2 we can see that the 4-MAT model has 4 main learning systems: what, why, how, and what if. Each learning system can then be divided into 2 parts to create 8 parts. The 4-MAT model is constructed from 2 continuums that is perceiving and processing. Perceiving is one's way of absorbing new knowledge and processing is what people do with the new knowledge. These two processes will always be present when human learn something new. Until today, there are a lot of researchs that use and developed the 4-MAT model to be better with various aspects and different subjects.



**Figure 2. 4-MAT Model**

In 2012, Prof. Zhou Ying feels that the 4-MAT model can be developed further to be better with a higher and deeper level. We can see in figure 3 that

the 6-questions cognitive model has 6 major learning system that consist of from where, what, why, how, what if and think about it (Lin et al.,2020)



**Figure 3. Six-Questions Cognitive Model**

“From where?” is about where the new knowledge is from. It aims to activate new knowledge growth points, give a strong new knowledge background, and find the starting point of learning. The information and questions given would be basic knowledge and questions so that students will know that this knowledge is important.

“What?” is to understand the new knowledge. What is the characteristic

and the basic knowledge on the new information? The important point is to put forward contextual questions on the new knowledge. This aims to find the problem and understand the core knowledge to achieve a deep understanding of the new knowledge.

“Why?” is about why we need to study new knowledge and what is its connection with the previous knowledge. Firstly, we can ask questions about the concept and guide students

why they need to learn new knowledge and what is the connection with the previous knowledge. With this, the goal to achieve deep learning and knowledge integration.

“How?” is how to learn this new knowledge, how to apply this knowledge in our daily life and how to use the knowledge to solve problems (Yi et al., 2019). The point is to ask procedural, strategic and applied questions about the basic concept that aims to test the knowledge and application of what students’ have studied.

“What if?” is about what will happen if the problem changes, how can this problem be applied in other problems and is there any other way to solve this problem (Cunhua et al., 2019). This focuses on the thinking skills and questions about condition change, conclusion and solving method. The objective is to guide students on how to ask critical and creative questions which is one of the indicators for high order thinking skills. It also guides students to improve their thinking skills in another way and to adapt to changes without changing.

“Think about it” is about guiding students to summarize and sum up what they have learned and what is the benefit of learning it. This focuses on the basic concept perspective, creativity, problem solving process and method and the emotional value to introspect the cognitive knowledge and guide students to plan, analyze and reflect on the knowledge. This aims to familiarize and adapt to the new knowledge and establish a good cognitive structure (Wijaya et al., 2020).

All these learning systems come together and create a systematic way of thinking that can help students achieve

HOTS. The use of 6-questions cognitive model will create a good learning system for students when they learn new knowledges but of course it needs time to apply the new learning system to become a habit. Based on the study done previously based on Scopus indexed journals and other journals (Wijaya et al., 2020), the 6-questions cognitive model has been applied to some mathematics topic. Based on the research done, 6-questions cognitive model can improve students’ mathematical ability.

The 6-questions cognitive model can still be further developed according to the situation. Cunhua et al. (2019) has tried to combine 6-questions cognitive model with the current technology. The 6-cognitive model will guide students to achieve high-order thinking skill and the technology will boost students’ learning interest (Yi et al., 2019). In the next research, researchers can discuss the use of the 6-questions cognitive model to help students achieve HOTS both in mathematics or other subjects.

Based on the discussion above, 6-questions cognitive model is developed by a professor from China. This can serve as information source and suggestions that can be introduced to school principal and teachers knowing that in 2022, PISA will be held to measure mathematical ability around the world.

## **Conclusion**

This paper describes the 6-question cognitive model that improves higher-order thinking skills in mathematics. Mathematics plays an important role in humans’ life and the development of modern technology. This is the reason why students should achieve mathematical HOTS. There are various ways to improve students HOTS

and one of them is by using a systematic learning model. A systematic learning model will develop students' systematic thinking approach so that students will not only be at LOTS. 6-questions cognitive model can be one of the alternatives for teachers to use. The 6 elements of 6-questions cognitive model would create a systematic thinking approach that can help students achieve HOTS. Based on the research done, 6-question cognitive model can improve students' mathematical skills and can also be used in other subjects.

This research needs further research to implement the 6-question cognitive model in mathematics lessons at various levels of education and various of mathematics content. Researchers support other researchers to support and use the 6-question cognitive model and prove the effectiveness of the 6-question cognitive model on many mathematical abilities in many countries.

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